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[Part of Vol. 18]

WAVE LENGTH MEASUREMENTS IN THE ARC SPECTRA OF NEODYMIUM AND SAMARIUM

BY

C. C. KIESS, Associate Physicist
Bureau of Standards

MAY 31, 1922

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By C. C. Kiess

ABSTRACT

The arc spectra of neodymium and samarium were photographed from 5475 A in the green out into the infra-red. The materials used for the work were neodymium oxalate and samarium oxide prepared at the University of Illinois and samarium oxalate prepared at New Hampshire College. The wave length tables contain about 1500 lines for Nd and about the same number for Sa. A third table contains 130 lines which were common to both spectra. These lines are of unknown origin and may belong to the missing element of order number 61, coming between Nd and Sa. The methods used for the work are identical with those described in a previous work on yttrium, lanthanum, and cerium.

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I. INTRODUCTION

In this paper are presented tables of wave lengths in the arc spectra of neodymium and samarium, extending from the yellow into the infra-red regions. This work continues an investigation of the spectra of the rare earth elements which was undertaken at the Bureau of Standards several years ago. A previous paper [1] contains results for the three elements, yttrium, lanthanum, and cerium, and describes the methods used for securing the spectrograms and deriving the final data from them. Inasmuch as the observational work on the various members of the rare earth group of elements was done at the same time, the reader is referred to this earlier paper for various details describing the work. The discussion in the present paper will therefore be limited to a statement of the results obtained for the elements neodymium and samarium.

[1] B. S. Sci. Papers, 17, p. 318; 1921.

II. RESULTS

The chief characteristic of the spectra tabulated below is the enormous numbers of lines, mostly faint, which they contain. These numbers are limited, apparently, only by the duration of the exposures and the sensitivity of the photographic plates. The tables are arranged (as in previous papers [2]) so as to exhibit in column 1, the wave length in international units; in column 2, the intensity and character of the lines; and in column 3, the probable error.

The second and third columns of the tables give symbols describing the intensity, character, and accuracy of the lines. The intensities range from 1 for the faintest lines measured to 10 for the strongest. The letters and symbols in the explanatory columns have the following significance:

b=broad.	R=reversed.
coin=coincident.	v=shaded to violet.
d=double.	A=probable error of 0.000 A to 0.010 A.
g=ghost.	B=probable error of 0.010 A to 0.020 A.
h=hazy.	C=probable error of 0.020 A to 0.030 A.
l=shaded to red.	D=probable error >0.030 A.
n=band head.	E=only one determination.
p=part of band structure.	

When the tabulated wave lengths for neodymium and samarium were intercompared, it was found that many lines, for the most part faint, were common to the spectra of both. It has not been possible to identify them with the spectra of known elements, and, therefore, they have been brought together in a separate table. While it would be a hasty conclusion to regard these lines as characteristic of a new element, yet the idea seems plausible in view of the fact that the present accepted scheme of the periodic table of elements requires a new element of atomic number 61 coming between neodymium and samarium.[3] Eder [4] has published similar lists of unidentified lines which he suggests may belong to elements not yet isolated, but none of the lines of Table 3 below agree with those in his lists.

1. NEODYMIUM

Table 1 contains about 1500 lines measured between the limits 5474 A and 8936 A in the arc spectrum of neodymium. Most of these lines are faint, very few being of intensity 4 or greater. A

[2] B. S. Sci. Papers, 17, p. 321; 1921.

[3] Sommerfeld, Atombau und Spektrallinien, pp. 55 and 58, 1st ed.: 1919.

[4] Kaiserl. Akad. der Wiss. Sitz. Wien, 126, IIa, p. 523; 1917. Akad. der Wiss. Sitz. Wien, 129, IIa, p. 434; 1920.

banded spectrum is practically absent, there being only a few faint lines that somewhat resemble band heads.

The material which was used for the majority of the spectrograms was neodymium oxalate prepared at the University of Illinois under the direction of Prof. B. S. Hopkins and kindly supplied by him to the Bureau of Standards for spectroscopic analysis. He has described the preparation of this material in a previous paper.[5] Comparison of the spectrum of this material with the spectra of other elements indicates that, with the exception noted above, it is very pure. In column 2 of the table agreements of several wave lengths with those of other elements are indicated, but it is believed that these are coincidences only, without any significance. In addition to the neodymium oxalate there were available for analysis a sample of magnesium neodymium nitrate and a sample of "didymium," each of unknown origin. Neither was very pure, being contaminated with other elements of the rare earth group; but the values of neodymium lines observed with them have been included in the means given below.

Eder and Valenta [6] have measured the spectrum of neodymium from 5473 A to 7808 A, using a neodymium chloride prepared by C. Auer von Welsbach. Their results are given on the Rowland scale. A later work by Eder,[7] using neodymium sulphate, also prepared by Auer, gives the spectrum in international units from 6432 A to 7808 A. The measurements of these investigators and those tabulated below are in good accord in the regions common to both.

TABLE 1.—Arc Spectrum of Neodymium

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5474.72	2	B	5500.06	1	B	5512.61	1	B
5475.41	1	B	5500.65	1	B	5514.00	1	E
5476.64	1	B	5501.50	3	B	5514.75	1 b, Er?	C
5477.36	1	C	5502.60	1	B	5515.64	1	B
5478.70	1 b, 1	C	5503.72	1	B	5516.00	1	C
5483.95	1	C	5504.52	1	E	5516.29	2	A
5485.04	3	B	5504.98	1 ES	E	5516.90	1	C
5485.72	5	B	5505.34	1	E	5518.40	1 ES	B
5487.02	2	B	5505.85	1	E	5518.74	2	B
5492.28	2	B	5506.71	1	E	5519.42	2 1	B
5493.37	2	B	5507.19	1	B	5520.02	2	B
5494.01	4	B	5507.63	2	B	5520.66	3	B
5495.56	1	B	5509.12	2	A	5522.16	2	B
5496.42	1	B	5510.70	1	C	5522.89	1	E
5498.86	1 ES	B	5511.93	1	E	5525.74	3	A

[5] B. S. Sci. Papers, **17**, p 342; 1921.
[6] Kaiserl. Akad. der Wiss. Sitz. Wien, **119**, IIa, p. 554; 1910.
[7] Kaiserl. Akad. der Wiss. Sitz. Wien, **124**, IIa, p. 110; 1915.

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5526.13	1	B	5577.75	3	B	5634.27	1 ES	E
5526.68	1	E	5578.63	3	B	5634.66	1	E
5527.01	1	B	5579.49	1	E	5635.74	3	A
5528.36	3	B	5579.93	1	B	5636.22	1	E
5529.05	2 ES	A	5580.49	1	B	5636.85	1	B
5529.36	1	E	5581.59	3	A	5637.20	1	E
5529.75	1	E	5582.03	1	E	5637.77	2 b	B
5530.48	2	B	5582.36	2	A	5639.00	2 v	B
5532.08	2	B	5582.80	1	E	5639.54	3	B
5532.44	1	C	5583.62	1	E	5640.50	2	B
5532.94	2	A	5584.20	2	B	5642.08	1 ES	E
5533.40	2	A	5584.41	1 ES	E	5642.64	1	B
5533.82	4	A	5586.06	1	E	5643.24	2	B
5535.27	3	A	5587.59	2	A	5644.14	2	B
5536.37	2 v	B	5587.95	3	A	5645.18	1	E
5536.85	1	E	5588.39	1	E	5645.50	1	E
5537.29	2	A	5588.84	3	A	5647.34	1	E
5537.76	2	A	5589.94	1	E	5647.98	2	B
5538.79	1	A	5590.67	2 b	C	5648.37	1	E
5540.42	1	E	5592.65	3	A	5649.22	1	B
5540.77	1	B	5594.43	6 Ca?	A	5649.80	1	E
5541.76	1	E	5594.97	1	B	5651.23	2	B
5543.24	3	A	5595.83	3 l	A	5652.67	1	B
5543.88	1 b	B	5596.61	1	E	5653.55	3 v, d?	B
5544.30	1	E	5597.81	2 v	B	5654.67	1	B
5544.87	1 b, l	B	5598.50	2 Ca?	B	5655.63	1	C
5545.90	3	E	5598.84	1	B	5656.49	2	A
5546.10	1	E	5599.99	1 b	B	5656.90	1	B
5546.50	1	B	5601.41	3	A	5657.37	1	B
5546.96	2	B	5601.91	3	A	5658.36	2	B
5547.72	2	C	5602.63	4	B	5659.77	4	A
5548.45	4	A	5604.28	1	D	5661.42	1	B
5548.68	3	A	5605.62	3 b, Pr?	B	5661.86	1	E
5550.09	3	A	5606.15	1	E	5662.44	2	B
5550.75	1	E	5606.63	1	E	5663.56	2	B
5551.91	1	C	5607.13	1	E	5664.26	1	B
5552.87	2	B	5607.50	1	E	5665.25	2	B
5553.31	1	E	5607.86	1	E	5665.73	2	B
5553.79	1 b	E	5608.81	1	E	5666.54	1	E
5555.02	1	E	5610.30	2	E	5668.23	1	E
5555.73	2	A	5611.15	2	B	5668.85	4	A
5556.64	1	E	5611.41	1	B	5669.28	2	E
5558.98	2	B	5612.12	1 b	B	5669.77	3	A
5559.81	2	B	5612.41	1	E	5670.88	1	E
5561.16	4	A	5613.13	1	E	5671.77	1 b, ES	C
5562.12	1 b, Pr?	B	5613.49	1	E	5672.14	1	B
5563.27	1	B	5614.26	4	B	5672.67	1	B
5564.53	1	E	5614.70	1	B	5673.22	1	B
5565.15	1 b	B	5615.29	3	B	5674.83	2	B
5565.76	2 b	B	5616.16	1	E	5675.92	6	A
5566.13	1	B	5616.58	1	E	5676.35	3	A
5567.24	1	B	5617.16	1	E	5677.81	2	A
5567.65	1	B	5619.03	3	B	5679.58	2	B
5568.15	1	E	5619.28	1	E	5680.19	1	B
5568.66	1	E	5619.66	1	E	5681.16	3	A
5569.05	1	E	5620.62	6	A	5682.51	1	E
5569.95	4	A	5622.28	2	B	5683.16	2	B
5570.71	2 l, d	B	5622.84	1	E	5683.69	1	E
5571.26	1	E	5623.36	2	B	5684.20	1	E
5571.54	1	E	5625.33	2	B	5684.63	1 l, n?	B
5571.81	1	E	5625.71	3	B	5685.00	1	E
5572.15	1	E	5626.64	2	B	5685.45	1	E
5572.38	1	B	5627.16	2 b	B	5686.60	3 l	B
5572.82	1	E	5628.41	1	D	5687.16	1	C
5573.46	1	E	5628.94	1	E	5687.84	1	B
5574.03	1	E	5629.45	1	E	5688.50	6	A
5574.66	2	A	5631.14	1	E	5689.06	1	E
5574.98	1	E	5632.15	1	E	5689.50	3	B
5575.50	3	A	5633.40	1	E	5690.20	2	B
5576.70	2	A	5633.92	1	E	5691.06	1	B

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5691.72	1 b	B	5761.67	3	B	5835.20	2	B
5693.03	1 b	E	5762.06	2	B	5835.89	1	E
5693.88	1	E	5762.36	2	B	5836.58	1	E
5695.18	2	B	5762.97	1	E	5837.15	2	A
5695.65	1	B	5763.52	1	E	5839.08	2	A
5696.01	1	E	5764.20	3	A	5839.72	2	A
5696.43	1	E	5766.53	2	A	5842.37	4	A
5697.22	2 b, d?	B	5767.33	3	A	5843.23	2	A
5699.71	1	E	5768.41	1	E	5844.66	3	A
5701.54	2	B	5769.86	3	B	5846.32	2	A
5702.25	4	A	5770.50	3	A	5847.09	1	B
5704.41	1	B	5771.42	2	E	5847.59	2	A
5705.08	1	E	5772.14	2	B	5848.37	2	A
5707.33	2	B	5773.89	1	E	5848.96	1	A
5708.28	6	A	5774.53	2 b	B	5849.59	1 b	E
5710.22	3 b	B	5776.10	2	B	5852.01	1 b, h	E
5713.85	1 b	E	5777.93	1 b	E	5853.00	1	E
5715.41	1	B	5778.47	1	E	5853.50	1	B
5716.69	1	E	5779.95	1	E	5853.75	1	D
5717.11	1	E	5781.30	1	E	5854.42	1	A
5717.61	1	E	5783.64	1	E	5857.50	2 Ca?	A
5718.12	5	A	5784.96	3	A	5857.98	1	E
5719.08	3	A	5788.19	2	B	5858.88	3	A
5720.02	1	E	5788.89	1	B	5859.68	2	A
5721.78	1	E	5791.06	1	E	5860.21	1	A
5722.34	1	E	5791.47	1	E	5860.60	1	E
5723.87	2	B	5792.90	1	E	5861.15	2	B
5726.24	1	E	5793.97	2 b	E	5864.03	2	A
5726.82	4	A	5795.15	3	A	5865.03	3	A
5727.86	2	B	5795.64	1	E	5867.05	3	A
5729.30	5	A	5797.35	1	B	5867.61	2	A
5730.29	2	B	5798.21	1 b	C	5868.88	4	A
5731.09	2	E	5798.91	1	E	5869.57	2 b, l	A
5731.77	2	B	5800.07	3	A	5870.98	3	A
5732.90	1 b	E	5801.85	1	E	5871.47	1	E
5734.20	2	E	5802.50	1	E	5872.00	1	E
5734.55	2	A	5804.01	6	A	5872.92	1	E
5736.04	1	B	5806.41	2 l	E	5873.33	2	B
5737.81	1	E	5808.78	1	E	5873.80	1	C
5738.11	1	E	5809.24	3	A	5874.39	2	B
5738.93	3 l, d?	A	5811.58	4	A	5874.76	3	B
5741.29	2	A	5812.80	1	E	5875.82	1	A
5742.06	4	A	5813.19	1	C	5876.34	2	A
5742.74	2	B	5813.87	3	A	5876.85	1 ES	E
5743.23	3	A	5814.71	1 b	E	5877.79	3	A
5744.13	2	B	5815.43	3	B	5878.20	1	B
5744.77	3	A	5816.41	1	E	5878.88	1	B
5745.66	1	B	5817.41	1	E	5879.26	1	B
5746.26	1	E	5817.82	1	E	5879.76	1	B
5746.87	2	E	5818.70	2 b, l	B	5880.25	2	B
5747.34	1	B	5819.26	1	E	5881.33	1	A
5748.15	3	A	5820.36	3	A	5882.75	3	A
5749.14	5	A	5820.56	1	C	5883.28	3	A
5749.63	2	A	5820.95	2	B	5883.66	1 ES	E
5750.08	1	E	5821.73	1	E	5884.63	1	B
5750.68	1 b	E	5823.30	3	A	5885.08	1	E
5751.38	1	E	5823.89	3	A	5886.22	3	A
5751.86	1	E	5824.58	1	E	5887.89	3	A
5752.36	1	E	5825.11	1	E	5890.50	2	A
5753.53	3	A	5825.87	4	A	5891.52	3	A
5754.10	2	B	5826.75	3 Er?	A	5892.69	2	A
5755.21	2	B	5829.13	1	E	5893.60	1 b, n?	A
5756.12	2	B	5830.72	2 l, n?	A	5894.86	2	A
5756.62	1 h	E	5830.95	1 l	B	5895.54	2	B
5757.50	1	E	5831.81	1	B	5896.67	1 b, l	A
5757.90	1	E	5832.21	1	E	5897.50	1 b, l	A
5758.32	1	B	5832.65	1	E	5898.85	2	A
5759.64	1	E	5833.14	1	E	5899.50	3	A
5759.97	3	B	5833.71	1	B	5900.43	3	A
5761.23	1	E	5834.55	2	B	5902.07	2 b, l, Er?	A

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5903.12	1	A	5960.17	1 b	E	6025.54	2	B
5904.82	1	E	5960.21	3	E	6028.26	1	E
5905.24	1	E	5961.15	2	B	6029.29	1	E
5905.80	2	B	5962.39	2	B	6029.76	1	E
5906.28	1	B	5964.19	1 b	E	6031.28	4	A
5907.54	1	E	5965.28	1 b	E	6031.76	1	E
5908.19	1 1	B	5966.01	1	E	6032.79	1	E
5909.32	1	B	5966.36	2	B	6033.30	4	A
5909.86	3	A	5966.74	2 b	B	6034.25	4	A
5910.29	2 1	A	5967.25	1 b	E	6035.13	1	E
5911.43	1	B	5967.85	1	B	6035.61	1 ES	B
5912.34	1 b	E	5968.30	2	A	6037.95	1	B
5913.08	1	E	5968.80	1 b, h	E	6038.89	1	E
5914.39	3	A	5970.86	1 b, n?	E	6039.91	1	C
5914.66	2 1, ES	B	5972.47	1	B	6040.98	2	A
5915.45	1	E	5974.57	2	B	6042.17	1	E
5916.13	1 b	E	5975.48	2	B	6043.80	1	A
5916.99	1	E	5976.33	2	B	6044.46	1	E
5917.46	2	B	5977.42	3 b, n?	B	6045.11	1b,n?Cu?	B
5918.02	1	E	5977.92	1	E	6047.54	1 b	E
5918.70	1 b	E	5978.82	1	B	6048.40	1 b, Cu?	C
5919.31	1	B	5979.96	2	B	6049.92	1	D
5919.81	2	A	5981.56	1	E	6050.50	2	A
5920.57	1	E	5982.02	1	B	6051.88	2	A
5921.20	3	A	5982.97	1	B	6053.40	1	A
5921.82	1	E	5984.81	1	B	6054.47	2	B
5922.33	1	E	5985.72	1	E	6056.26	1	B
5922.79	3	A	5985.96	2	B	6056.99	1	B
5923.27	1 b	E	5986.88	1 ES	B	6057.30	1	E
5924.31	1	E	5988.16	2	B	6057.59	1	E
5926.00	1	E	5988.81	1	E	6058.33	2	A
5926.50	1	E	5990.21	2	A	6058.81	1	B
5927.94	2	B	5990.79	2	A	6060.38	1	E
5928.93	2	B	5992.40	1	B	6061.05	3 b, Cu?	B
5929.79	1 v	E	5994.04	2	A	6062.30	1	E
5931.43	2	B	5994.77	4	A	6064.59	1	E
5932.08	1	B	5995.93	1	E	6065.18	2	B
5933.17	1	B	5996.47	4	A	6066.07	4	A
5933.75	1	E	5996.95	1	B	6067.00	2	E
5934.77	2	B	5998.32	1	E	6068.73	3	B
5936.59	1 b	E	5998.80	1	B	6069.70	2	E
5937.52	1	E	5999.50	1	E	6070.43	1	E
5938.07	1	E	6000.69	2	B	6071.04	1	E
5939.09	1	B	6000.64	1	E	6071.71	4	A
5939.73	3	B	6001.41	1 b	B	6073.09	1	E
5940.00	3 1	B	6002.45	2 b	B	6073.96	4	A
5942.04	1	B	6003.95	1	B	6075.20	1	C
5942.68	1	B	6004.33	1	B	6076.33	1	B
5943.21	3	A	6005.43	1	E	6077.23	2 b, n?	A
5944.51	1	E	6005.90	1	E	6077.42	1	E
5944.90	1 b	E	6006.44	2	B	6079.99	1	E
5945.63	1	E	6007.67	4	A	6080.61	1 b	E
5946.29	2	E	6008.82	1	E	6081.53	1	E
5946.70	1	E	6009.29	2	A	6082.02	1	E
5947.36	2	A	6010.86	2	B	6082.96	1 b, d?	E
5948.14	1	E	6011.50	2	A	6084.62	2	B
5948.46	2	B	6012.90	1	E	6086.94	2	B
5949.61	3	B	6013.98	1 b, h	E	6087.50	1	C
5950.47	2	A	6015.33	1	A	6087.90	1	E
5950.98	1	E	6015.74	1	E	6088.01	1 b	E
5953.05	2	B	6016.30	1	B	6091.24	2	E
5953.53	1	E	6017.21	1	B	6091.58	2	B
5954.47	1	E	6017.75	1	B	6092.06	2	B
5955.16	1	B	6018.05	1	E	6093.03	1	E
5955.88	3	A	6018.93	1	E	6093.76	1	E
5956.32	1	E	6020.23	2 b, 1	B	6094.98	1	E
5957.07	1	E	6022.04	1	B	6096.41	1	E
5957.58	1	E	6022.75	2 b, d?	B	6097.79	2	C
5958.00	1	E	6023.45	2 b, d?	B	6099.18	1 v	E
5958.65	1	B	6024.65	1	E	6100.09	1 1	E

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
6101.74	3	A	6221.15	1 v, Cu?	E	6365.56	3	A
6104.06	1	E	6222.15	1 l	A	6366.74	1	B
6105.50	1	C	6223.38	3 l, d?	C	6372.80	2	A
6106.14	1	E	6226.50	3	A	6375.96	3	A
6106.69	1	E	6227.18	2	A	6377.30	2 n?	B
6107.24	1 b	B	6238.49	3	A	6382.06	3	A
6107.74	1	E	6243.31	1	B	6383.17	2	B
6108.42	4	B	6244.06	3	B	6384.62	1	B
6109.08	2	B	6248.27	2	A	6385.17	4	A
6109.68	2	C	6250.41	2	B	6386.53	1	B
6111.37	1	E	6251.82	2	A	6386.94	1	E
6113.47	2	A	6257.49	3	A	6390.00	3	A
6113.98	1	B	6258.74	3	B	6395.88	1	E
6114.45	1	B	6260.67	1 n?	B	6396.88	1	A
6117.19	1	E	6263.23	3	A	6402.75	1	B
6117.63	1	E	6269.40	1	A	6403.22	2	A
6119.86	1	E	6270.26	1	A	6410.58	1	B
6120.80	1	B	6271.69	1 v	E	6414.04	1	B
6121.25	1	E	6277.30	3	A	6414.37	1	B
6122.16	2	B	6278.18	1 b	E	6416.80	1 b	B
6122.99	2	B	6278.93	1	B?	6419.09	1 b	E
6128.50	1	E	6279.36	1	B	6420.71	1	B
6129.20	2	B	6279.66	1	B	6425.80	2	A
6130.60	2	A	6282.00	3	A	6427.02	1	E
6131.82	2	B	6282.47	2	A	6428.66	3	A
6132.62	1	E	6283.94	1	E	6429.84	2	B
6133.53	3	A	6284.68	1	E	6431.16	2	B
6133.92	2	B	6285.78	2	A	6431.71	2	B
6135.21	1	E	6287.19	2	A	6432.66	3	A
6137.37	1	E	6287.59	1	B	6433.22	2 n?	B
6137.88	1	E	6288.03	1	A	6434.59	1	E
6141.86	1	B	6291.99	2	A	6435.00	2	A
6142.42	1	B	6292.84	3	A	6436.06	1	E
6144.54	1	A	6293.59	2	A	6439.18	1	B
6149.28	4	A	6294.42	1	E	6439.86	1	B
6150.23	1	B	6297.07	3	A	6442.98	1	E
6152.75	2	B	6298.41	3	A	6445.80	2	A
6155.06	4	B	6300.44	1	B	6448.82	1	E
6156.18	3	A	6300.98	2	A	6451.21	2	A
6156.57	1	B	6301.91	3	A	6452.66	1	E
6157.83	4	A	6305.76	1 n?	B	6455.06	1	E
6159.24	1	E	6310.48	4	A	6457.14	2	A
6159.92	1	E	6312.70	1 b	B	6457.90	1	B
6161.44	4 b, n?	B	6313.26	2	A	6458.98	1	E
6162.38	2	B	6319.67	2	A	6463.57	2	A
6163.48	1	E	6321.22	2	A	6465.23	2	B
6164.42	2	B	6322.87	2	A	6470.61	1 b	E
6165.14	2 b	B	6326.93	2	A	6471.71	1 b	E
6165.63	2	B	6328.47	2	A	6476.23	1	E
6166.67	3	A	6331.87	2	A	6478.78	1	E
6168.06	1	E	6333.89	1	A	6479.82	1	B
6170.49	4	A	6338.83	1	B	6480.25	3	A
6171.88	1	B	6340.00	1	E	6481.57	1	E
6176.08	2	B	6341.47	4 b	A	6482.26	2	B
6176.60	1	E	6343.05	1	E	6483.43	1	B
6178.59	4	A	6347.81	2	B	6484.37	1	A
6179.47	1	E	6348.78	1	B	6485.69	4	A
6180.73	1	E	6349.83	1	E	6487.55	1	C
6181.57	1	E	6351.96	2	A	6489.16	1	B
6182.98	2	E	6353.57	1	E	6492.33	2 Er?	A
6183.87	3	A	6354.25	1	E	6495.59	1	E
6196.21	1	B	6354.75	1	A	6500.15	2	A
6198.64	1 b	B	6355.95	2	A	6501.11	1 b	E
6201.74	2	A	6356.54	2	A	6501.86	1	E
6206.07	1	B	6358.36	1	E	6504.45	2	A
6207.96	1	E	6360.86	1	E	6504.92	1	A
6208.23	3 v	A	6361.44	3	A	6507.30	1	E
6212.79	1	E	6362.10	3	A	6514.93	2	A
6216.71	2	A	6363.94	1	B	6519.86	1	A
6218.16	1	A	6364.94	1	E	6523.12	2	A

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
6539.91	2	A	6709.06	1	E	7024.58	2	B
6541.09	1	E	6712.27	2	A	7033.21	1	E
6543.74	1	E	6713.26	1	B	7037.30	3	A
6547.72	1	A	6714.15	1	B	7056.99	3	A
6549.50	2	A	6718.32	1	E	7069.84	1	E
6550.18	2	A	6719.92	1	E	7092.64	1	E
6553.06	2	A	6722.72	1 b	E	7093.93	1	C
6558.95	2	A	6723.46	1	B	7100.50	1	E
6560.27	1	E	6723.26	1	B	7113.80	1 b	E
6563.94	1 h	E	6727.70	3	A	7116.84	1 b	E
6568.45	1	B	6728.93	2	A	7129.35	3	A
6569.56	1	B	6734.57	1	E	7142.04	1	E
6571.80	1	B	6735.04	1	B	7143.72	1	E
6572.66	2 b	B	6737.79	3	A	7148.23	1 Cu?	E
6575.96	1	E	6739.16	1	B	7150.93	1	E
6577.73	1	C	6740.05	4	A	7157.84	1 l, n?	E
6580.81	1 v	B	6742.50	2	B	7170.36	1 b	E
6580.99	2	E	6743.18	1	B	7183.60	1	E
6581.84	1	B	6748.13	1 b	C	7185.01	1	E
6582.61	1	E	6753.60	1	E	7189.42	3	B
6583.47	1 Er? Cu?	A	6763.01	2	A	7192.01	2	A
6584.59	1	E	6763.78	2	A	7198.83	2	E
6585.70	2	A	6764.61	2	A	7215.32	1	E
6588.02	2	A	6765.78	1	E	7235.24	1	E
6589.04	1	C	6770.94	1	E	7236.52	3	B
6589.64	1	A	6780.61	2	B	7242.16	1	E
6590.94	1	E	6782.50	1	A	7243.23	1	E
6591.40	1	A	6789.10	1 v, d?	B	7261.71	1	E
6592.66	1	E	6790.49	4	A	7266.22	1	E
6595.00	1	A	6791.67	1	C	7268.31	1	E
6596.35	1	B	6792.28	1	B	7272.26	1	E
6601.75	2	A	6795.34	1	B	7279.36	1	A
6603.68	1	E	6796.48	1	E	7285.30	3	A
6604.44	1 b	C	6801.34	2 h	B	7288.52	3	A
6609.30	1	E	6803.97	4	A	7291.38	2	A
6609.68	1	E	6806.24	1	B	7298.77	1	B
6611.99	3	A	6812.30	1 b	B	7308.78	1	A
6615.88	1	B	6816.00	2	A	7311.91	1	E
6616.89	1	E	6822.91	1	B	7313.70	1	E
6618.49	3	A	6825.35	1	A	7316.80	3	A
6619.34	3	A	6842.67	2	A	7321.43	2	A
6624.26	1 b	E	6846.73	4	A	7323.10	2	A
6625.40	1	E	6849.30	1 b	E	7324.63	1	E
6630.14	4	A	6853.23	2	B	7327.89	1	A
6636.15	1	C	6853.72	1	E	7330.80	1	E
6637.96	3	A	6855.69	1	E	7333.19	1	B
6650.57	4	A	6856.96	1	B	7334.56	2	A
6655.64	4	A	6865.52	1	E	7343.49	1	A
6659.47	4	A	6868.67	1	E	7346.43	1	B
6660.16	2	A	6873.78	1	E	7350.32	1	C
6662.55	1	E	6874.66	2	A	7354.09	1	B
6664.61	1	B	6876.00	2	A	7357.16	2	A
6665.78	1	E	6878.41	1	B	7360.53	2 b, v	B
6667.54	1 l	B	6886.56	2	B	7363.28	1	B
6669.61	2	A	6896.65	2	A	7366.24	1	E
6670.37	2	A	6897.29	1	A	7374.04	2	A
6671.10	1	E	6900.40	4	A	7376.48	1	B
6673.09	1	B	6901.33	2	B	7378.26	2	B
6675.07	1 n?	B	6923.86	2	A	7381.81	3	A
6675.96	1	E	6926.87	2	A	7383.52	1	B
6678.52	2	A	6927.99	1	E	7390.18	1	B
6679.75	1	A	6932.16	1	A	7391.25	1	B
6680.14	2	A	6936.44	1 h	E	7394.40	1	B
6681.12	1	E	6938.67	1	A	7397.13	1	E
6683.52	1	E	6940.14	2	A	7399.46	1	E
6690.15	1	E	6941.39	2	A	7401.31	3	A
6693.77	1	E	6964.64	2 b	A	7403.38	1	C
6695.62	1	E	6982.65	1	E	7404.78	2	A
6698.65	2	A	7010.80	1 b	E	7406.62	3	A
6702.70	1	B	7020.92	2	A	7409.73	2	A

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
7411. 20	2	A	7621. 69	1	B	7845. 51	2	A
7418. 18	4	A	7623. 93	1	E	7851. 99	1	B
7422. 24	1	A	7624. 82	1	E	7853. 24	2	A
7424. 48	1	B	7626. 40	1	A	7857. 51	1	B
7427. 41	3	A	7628. 95	1	A	7858. 94	1	E
7430. 00	1	B	7632. 82	2	A	7859. 90	1	E
7432. 20	1	D	7636. 77	1	C	7862. 84	4	A
7433. 31	1	C	7637. 80	1	E	7867. 10	1	E
7436. 05	1	E	7639. 79	3	A	7869. 51	1	E
7437. 56	1	B	7645. 98	3	A	7872. 03	2	A
7441. 57	1	E	7654. 53	1	B	7874. 08	1	B
7442. 82	1	E	7656. 11	1	B	7877. 67	1	E
7445. 57	1	A	7657. 35	1	E	7880. 23	1	E
7448. 76	4	A	7659. 35	1	E	7881. 45	1	B
7451. 11	1 b	E	7661. 17	1	A	7886. 60	2	A
7456. 91	1	E	7663. 48	3	A	7896. 50	2	A
7458. 98	1	C	7673. 88	1	E	7898. 29	1	E
7466. 46	1	E	7675. 10	1	E	7900. 38	2	A
7468. 16	2	B	7677. 25	1	E	7906. 03	2	A
7472. 48	1	E	7678. 78	1	E	7908. 51	1	E
7475. 55	2	A	7682. 59	1	C	7915. 22	1	E
7476. 67	2	A	7684. 83	2	A	7917. 01	3	A
7478. 62	1	B	7690. 02	1	A	7921. 63	1	B
7481. 37	2	A	7691. 76	1	E	7923. 12	2	A
7483. 88	2	A	7693. 97	1	E	7925. 03	3	A
7485. 03	1	E	7695. 46	1	B	7927. 43	2	A
7487. 48	1 b	E	7696. 61	4	A	7943. 05	1	E
7489. 49	1	B	7698. 80	2	A	7947. 95	1	A
7491. 56	1	E	7705. 70	2	A	7949. 65	3	A
7493. 39	1	E	7711. 58	2	A	7951. 54	1	E
7494. 93	1	E	7715. 17	1	E	7955. 38	2	B
7507. 81	1	C	7718. 15	3	A	7957. 47	2	A
7511. 16	4	A	7721. 25	1 b	B	7958. 93	4	A
7513. 84	5	B	7724. 84	2	A	7963. 95	1	B
7514. 44	1	E	7727. 76	1	E	7965. 69	4	A
7516. 01	2	A	7729. 21	1	E	7967. 88	1	C
7523. 09	1	B	7736. 01	1	C	7970. 64	1	E
7526. 49	3	A	7740. 80	2	A	7972. 05	1	E
7529. 01	4	A	7743. 87	2	A	7974. 47	1	E
7534. 12	1	E	7749. 02	2	A	7982. 34	4 b	A
7535. 79	2	A	7750. 97	3	A	7984. 75	1	B
7538. 27	4	A	7753. 56	1	A	7987. 04	1	E
7540. 98	2	A	7755. 38	1	B	7988. 71	1	E
7543. 31	1	E	7757. 45	1	B	7989. 79	1	E
7544. 70	1	B	7758. 94	1	A	7991. 22	1	E
7545. 89	1	E	7765. 39	1	C	7996. 12	1	B
7547. 00	3	A	7767. 00	1	A	8000. 75	4	A
7549. 20	1 d?	B	7768. 02	2	A	8005. 34	1 1	B
7550. 90	1	B	7773. 14	3	A	8007. 72	3	A
7553. 21	1	B	7775. 48	1	E	8010. 22	1 b	C
7555. 63	1	C	7777. 11	1	C	8015. 32	1	C
7563. 21	2	A	7779. 87	1	C	8020. 08	2	B
7566. 00	2	A	7785. 88	1	B	8031. 44	1	E
7575. 82	1	E	7787. 37	2	A	8033. 29	1	E
7577. 54	2	A	7792. 27	3	A	8034. 60	1	E
7579. 18	2	A	7796. 37	2	A	8036. 38	1	E
7580. 88	1	E	7797. 32	2	A	8040. 43	1	E
7583. 84	1	E	7804. 39	1	A	8043. 33	4	A
7587. 65	3	A	7808. 50	4	A	8044. 66	1	E
7590. 49	3 b, v	B	7811. 26	1	B	8051. 30	2	A
7595. 93	2	A	7814. 33	2	A	8053. 38	1	E
7597. 10	1	B	7818. 86	3	A	8064. 00	2	A
7599. 80	1	E	7822. 00	1	E	8071. 56	2	A
7603. 75	2	A	7825. 24	2	A	8077. 05	1	D
7605. 94	2	A	7827. 90	1	A	8078. 95	1	E
7607. 78	1	E	7829. 66	1	E	8082. 18	1	C
7611. 14	1	B	7831. 44	1	E	8085. 74	1	E
7613. 73	1	E	7837. 20	2	A	8099. 09	3	A
7614. 69	2 b, d?	B	7842. 77	1	E	8108. 66	2	B
7618. 63	1	B	7844. 30	2	A	8118. 78	2	B

TABLE 1.—Arc Spectrum of Neodymium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
8120.85	3	A	8265.16	1	C	8431.07	1	E
8122.08	3	A	8266.71	3	B	8450.14	1 b	E
8131.89	1	B	8270.06	1 b	E	8453.90	1	E
8133.53	1	D	8272.75	2	B	8456.80	3	B
8141.72	4	A	8275.86	1	E	8459.17	1	E
8143.29	4	A	8280.78	1	B	8473.13	1	E
8150.33	1	B	8283.52	2	B	8475.32	1	E
8158.46	1	B	8288.54	1	B	8479.98	1	B
8161.72	1	B	8299.75	1	B	8485.80	1 v, d?	C
8164.97	3	A	8301.44	1	B	8488.36	1	E
8166.79	1	B	8302.74	2	B	8514.31	1	E
8169.78	2	B	8307.72	3	A	8522.92	1	E
8172.49	3	A	8308.88	1	E	8527.84	1	B
8174.48	1	C	8311.15	1	B	8530.44	1	B
8177.24	1	E	8313.05	1	E	8533.71	1	E
8179.83	3	A	8318.59	1 v, d?	C	8546.43	1	E
8182.41	3	A	8324.51	3	A	8547.72	1	E
8185.63	3	A	8332.01	2	B	8554.53	1	E
8194.41	1	B	8333.22	1	E	8574.62	1	E
8198.56	1	E	8336.63	2	C	8582.03	1	E
8200.99	1	E	8338.70	1	E	8591.43	1	E
8201.59	1 b	D	8346.35	3	A	8592.15	1	E
8204.17	1	C	8354.50	1	D	8594.84	2	B
8205.36	3	B	8356.62	1	C	8605.48	1	E
8206.57	1	B	8360.70	1	C	8622.83	1	E
8213.17	2 v, d?	B	8362.45	2	B	8625.11	1	E
8216.97	2	B	8367.16	1	E	8643.45	2	B
8220.27	1	B	8372.47	1	E	8656.45	1 b	E
8222.28	1	B	8375.23	3	B	8667.00	1	E
8227.36	2	B	8382.19	1	B	8677.48	1	B
8231.47	3	A	8386.68	2	C	8691.30	1	E
8236.41	1	E	8390.69	1	E	8695.07	1	E
8243.08	1	B	8394.72	2	B	8705.87	1	E
8245.42	1	B	8398.17	1	E	8712.84	1	E
8248.77	3	B	8400.79	2	C	8715.01	1	E
8249.70	3	B	8403.96	1	C	8717.49	1	E
8253.41	1	C	8408.25	1 b, Cu?	C	8730.35	1	E
8255.21	1	E	8409.70	1 b	E	8789.69	1	E
8257.97	1	B	8424.93	1	E	8838.96	2	E
8262.80	2	B	8426.32	1	E	8935.97	1	E

2. SAMARIUM

The arc spectrum of samarium, like that of neodymium, is very rich in lines, most of which are of low intensity. In Table 2 there are about 1500 wave lengths between the limits 5475 A and 9265 A. Only a few faint unsymmetrical lines are suggestive of a band spectrum.

The material used for the greater portion of the work was samarium oxide supplied by the chemical laboratory of the University of Illinois. Its preparation has been described by Hopkins and Kremers.[8] A second series of spectrograms was made with some samarium oxalate of atomic weight grade prepared at New Hampshire College by Stewart and James.[9] The arc spectra of these two preparations were identical and apparently free from the

[8] B. S. Sci. Papers, 17, p. 339; 1921.
[9] J. Am. Chem. Soc., 39, p. 2605; 1917.

lines of impurities, especially of other known members of the rare earth family. However, in the spectra of each of these materials appear numerous lines in agreement with some of those tabulated by Eder and attributed by him to an hypothetical element "eurosamarium."[10] It is to be noted, however, that it is his fainter lines only that agree with wave lengths tabulated below. Almost without exception the stronger "eurosamarium" lines are not to be found in Table 2, where the wave lengths in question are marked by the symbol "ES." Among a number of spectrograms of the rare earth preparations of C. Auer von Welsbach recently received at the Bureau of Standards from Prof. J. M. Eder, of Vienna, there were several of samarium. Some of these plates have been measured and the results are included in Table 2.

Measurements in the arc spectrum of samarium in international units have been made by Eder,[11] who, using a very pure sample of samarium sulphate prepared by Auer, derived the spectrum from 2575 A in the ultra-violet to 7082 A in the red. The agreement between his results and those given below is, in general, good, but each list contains faint lines not to be found in the other.

TABLE 2.—Arc Spectrum of Samarium

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5475. 20	3	B	5509. 64	2	B	5534. 14	1	B
5478. 29	4	B	5510. 46	2	B	5534. 95	1 b	E
5479. 72	1	C	5511. 09	3	A	5535. 49	2 Ba?	E
5480. 66	2 ES, Yt?	B	5512. 10	4	A	5536. 15	1 ES	E
5482. 16	1	C	5512. 91	1 Ca?	B	5537. 07	4	A
5484. 56	1	B	5513. 89	1	B	5538. 38	2	B
5485. 44	5	B	5514. 57	1	E	5539. 94	1	B
5485. 12	1	E	5515. 07	1	E	5541. 46	3 b, d, g coin?	B
5487. 16	1	E	5516. 12	6	A			B
5488. 13	3 d?	B	5516. 99	1	B	5542. 68	3	B
						5543. 60	2	B
5488. 93	2	B	5517. 58	1	E			
5489. 38	1	C	5517. 98	1 ES	E	5544. 44	2 ES	B
5490. 04	1	C	5518. 31	1 ES	E	5545. 03	1 ES	E
5490. 65	4	B	5518. 86	9	B	5545. 28	1 ES	E
5491. 27	1	B	5519. 64	5	B	5546. 47	1	B
						5547. 79	1	B
5492. 48	2	B	5520. 84	1	E			
5493. 70	6	B	5521. 65	3	B	5548. 27	1	B
5494. 34	3	B	5522. 38	1 l, d?	E	5548. 96	4	A
5496. 88	1	B	5523. 30	2 l, d?	C	5550. 37	6 R	A
5495. 57	2	B	5524. 31	1	E	5553. 02	3	B
						5553. 89	1	B
5496. 74	1 b	B	5525. 56	3	A			
5498. 21	6	A	5526. 21	4 b	B	5554. 88	3 ES	B
5500. 88	2	B	5527. 51	1	E	5556. 34	2	B
5501. 66	2	B	5528. 48	1 Mg?	B	5558. 60	1 ES	E
5502. 69	1 b, d?	B	5528. 94	2 ES	B	5558. 84	1	E
						5560. 59	2	B
5503. 52	2	B	5529. 92	3 ES, g coin?	B			
5504. 02	2	B				5561. 39	3	A
5505. 18	2 b, ES coin?	B	5530. 30	1	E	5561. 78	1	E
			5532. 58	3	B	5562. 33	1	B
5507. 12	2	B	5532. 78	2	B	5563. 09	1	E
5509. 30	1	B	5533. 72	1	B	5564. 24	2	B

[10] Kaiserl. Akad. der Wiss. Sitz. Wien, 126, IIa, p. 523; 1917.
[11] Idem, 125, IIa, p. 883; 1916.

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5565.56	2 ES	B	5636.68	2 ES	B	5701.12	2	E
5567.94	2 l, d?	B	5637.30	3	A	5702.23	1	B
5569.18	2 v, d?	B	5638.65	2 ES	B	5704.10	1 g coin?	B
5570.57	3	B	5639.88	1	B	5705.72	1	E
5571.98	1	B	5640.27	2	A	5706.77	3, Yt?	A
5573.42	4	A	5640.77	1	B	5707.20	2	C
5573.94	1	B	5642.01	1 ES	C	5707.84	1 ES	A
5574.32	1	C	5642.86	2 ES	B	5708.33	1 Nd?	B
5574.86	3	A	5643.36	1	D	5708.78	3 l,d? ES	B
5575.61	2	B	5644.10	6	A	5709.71	3 ES	A
5575.98	1 ES	B	5646.00	2	B	5710.29	2	A
5577.61	1	C	5647.31	4	B	5710.93	4	A
5578.87	3	A	5649.00	2	B	5711.43	3	A
5579.64	1	B	5649.59	1	B	5712.04	1	B
5580.42	1	B	5650.37	2	B	5712.53	1	B
5581.84	3	B	5651.66	1	B	5713.60	1	B
5583.71	1	E	5652.84	3	B	5714.27	3 l,d? ES	B
5584.11	2 l	B	5655.55	2b	E	5715.60	2 l	B
5584.71	1	E	5656.38	4	A	5716.54	2 l, ES	B
5586.16	1	B	5657.21	3	B	5717.93	3 ES	A
5587.00	2	C	5658.10	3 v, ES	B	5719.15	3	A
5587.45	1	B	5659.89	5	A	5719.81	1	E
5588.18	4	A	5661.16	2	A	5720.23	3	B
5589.20	3 ES	C	5661.54	2	A	5721.36	4	A
5589.86	3	A	5663.00	2 ES, Yt?	A	5722.57	1	B
5591.15	2	B	5663.89	3	A	5724.47	2 ES	A
5591.67	3	A	5664.73	2 ES	A	5725.58	2 ES	A
5592.36	3 l, d	B	5666.04	2	B	5726.08	1	B
5593.58	1	D	5666.70	2 b,d?	C	5727.08	2 l,d? ES	B
5594.14	1	E	5667.41	3	B	5728.44	1 v	B
5594.55	3	B	5667.91	1	C	5729.31	2 Nd?	A
5595.32	2	B	5668.35	1	E	5730.06	3	B
5598.08	1	B	5668.92	2	D	5731.38	1	B
5598.62	2	B	5669.58	2b	B	5732.94	4	A
5600.86	5	A	5670.68	3b	B	5733.58	3	A
5605.44	1	B	5671.56	1	C	5734.33	1	B
5605.93	1	B	5672.35	1	B	5735.04	3 l, ES	B
5606.52	2	B	5672.87	2	A	5736.31	1	B
5609.65	1 ES	B	5673.70	1	B	5736.83	2	B
5610.03	2	B	5674.12	2d	B	5738.01	4	A
5610.37	1	B	5674.62	1	E	5738.52	1	E
5611.29	3 d? ES	B	5675.55	1	E	5739.32	2	B
5611.84	2 ES	B	5676.10	2l,d? ES	B	5741.18	2	B
5612.94	2	B	5677.33	1 lh	B	5743.35	5	A
5614.37	2	B	5678.69	1	B	5744.23	2 ES	B
5615.01	1 ES	B	5679.13	2	B	5745.02	2	B
5618.36	1	C	5679.72	3	B	5745.47	3	A
5619.14	2	B	5679.99	1	E	5746.52	2	A
5619.76	1	B	5680.90	3	C	5747.54	1 Tb?	B
5620.86	1 ES	B	5682.40	2 ES	B	5748.06	3	A
5621.83	5	A	5683.91	2	B	5748.45	1	E
5622.66	2	B	5684.98	1	B	5749.46	1	B
5622.95	2	B	5685.50	1	E	5750.73	2 ES	B
5624.66	2	B	5686.85	5	A	5751.42	3	B
5624.96	2	B	5687.69	3	B	5752.16	1	B
5626.02	5	A	5688.17	1	B	5752.58	1	B
5626.65	1	E	5688.50	1 Nd?	B	5753.15	2 ES	B
5627.69	3	B	5689.24	2	B	5754.38	2	B
5628.14	2	B	5690.35	2 ES	E	5755.89	2 ES	B
5629.11	1 b	C	5690.60	1	E	5756.40	2 ES	A
5630.81	1 ES	B	5691.60	2	B	5756.76	1	E
5631.73	1	B	5692.04	3	A	5757.33	1	B
5632.03	1	B	5693.65	3	A	5757.97	3	A
5632.35	1	B	5695.81	1	B	5758.50	2	B
5633.03	2	B	5696.25	3 Gd?	B	5759.53	5	A
5633.53	2	B	5696.75	4	B	5760.85	3 b,ES	B
5634.17	1 ES	B	5697.67	1b	E	5761.73	2	B
5634.51	1	E	5698.40	1	E	5762.43	2	B
5635.64	2 b	B	5699.58	3 ES	E	5763.35	3 ES	B
5636.13	1	E	5700.25	1	E	5763.89	3	A

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5764.31	2	B	5833.40	2	B	5900.69	2 ES	A
5765.01	3	A	5834.14	1	B	5901.38	2	A
5765.89	2	B	5834.84	2 b, d?	B	5902.35	1	B
5766.46	2	B	5836.37	4	A	5902.61	3	B
5767.12	1	B	5837.42	2	E	5903.04	1	B
5768.11	3	B	5838.43	2	A	5903.53	3	A
5769.80	2	B	5839.53	1	E	5903.97	1	E
5770.54	1	B	5839.87	2	A	5906.05	2	A
5770.90	2 ES	E	5841.31	1	E	5907.91	1	E
5771.69	3 ES	B	5841.96	2	A	5908.47	1	B
5773.14	1	E	5842.60	3	A	5909.04	3	A
5773.79	5	A	5843.75	3	A	5909.86	1 Nd?	E
5774.44	1 g coin?	B	5844.91	1	B	5910.03	1 Ce?	E
5774.98	1	E	5846.54	2	A	5910.81	3	A
5776.33	4 b	B	5847.36	1	B	5912.61	3	A
5777.10	2	B	5848.67	3	A	5913.56	2	A
5778.36	4 g coin?	A	5849.71	2 ES	A	5914.90	2	A
5779.27	4	A	5850.94	2	A	5915.56	2	A
5780.31	1	E	5851.98	2	B	5916.37	2	A
5780.87	1	E	5853.07	2	A	5917.94	1 ES	B
5781.93	4	E	5853.44	1	E	5919.33	3	A
5783.50	3	E	5854.59	2 b	B	5920.41	1 h	E
5784.72	1	E	5855.33	1	B	5921.00	3	A
5785.90	3 b,d,g coin?	B	5855.98	1	B	5921.25	1	E
5787.06	5	A	5857.09	2	A	5921.74	2	B
5787.55	2	A	5858.09	2	B	5922.44	2 l, ES	B
5788.39	4	A	5859.23	2	B	5923.33	3	A
5789.35	1	B	5859.78	1	E	5924.18	2	A
5790.36	2	B	5860.36	4 d?	A	5924.66	2	A
5791.00	3 ES	B	5860.82	2	B	5925.92	1	B
5791.77	2	B	5861.41	1	E	5926.44	2	A
5792.76	1	E	5862.50	1	E	5927.83	2	A
5793.29	3	B	5863.85	1	E	5928.35	1	A
5794.10	1	E	5864.47	2	A	5929.19	2	B
5794.22	3	B	5866.13	1	E	5930.89	1 v	B
5795.29	2	B	5867.36	1	E	5931.52	1 ES	B
5797.31	1	B	5867.77	4	A	5931.89	3	B
5797.86	2	C	5868.62	4	A	5932.90	2	A
5798.64	1	C	5869.93	1	E	5933.94	1	B
5799.50	1	E	5870.31	1	E	5935.05	1 ES	B
5800.51	4	A	5871.07	3	A	5936.12	2	A
5801.24	3	A	5873.02	1	E	5937.76	1	B
5801.66	2	A	5874.22	4	A	5938.90	4	A
5802.86	5	A	5875.09	2	A	5939.92	1 b	B
5803.94	1	E				5940.69	1	C
5804.70	2	A	5875.92	2	A	5941.43	3	B
5805.69	1 Ba?	E	5876.82	2 ES	A	5942.30	3	A
5806.25	1	B	5878.11	3	A	5943.00	2	A
5806.77	3	A	5878.42	1	E	5944.72	1 v	B
5810.33	2 ES	B	5879.36	2 v, d?	B	5946.33	2	A
5811.44	2 b	B	5880.51	1 ES	B	5947.43	2 ES	B
5812.66	3	A	5881.64	2 b, d?	B	5950.14	3 v	B
5813.08	2	B	5882.51	2	A	5951.95	1	B
5813.84	1	E	5883.67	2 ES	A	5952.37	1	B
5814.88	5	A	5885.47	1	B	5955.82	3	A
5816.34	3	A	5886.07	1	B	5956.79	2	A
5817.49	2	B	5887.27	2	A	5957.52	2	A
5819.51	2 b, d	B	5888.01	3 l, d?	C	5958.21	1	A
5820.60	2	A	5889.77	3	C	5960.09	2	A
5823.18	2 ES	B				5963.92	1	A
5824.00	3 b	A	5890.61	2	A	5965.71	4	A
5825.64	3	A	5891.42	2	A	5966.36	1	B
5826.30	1 Ba?	B	5892.22	3 b	B	5967.06	2 b	B
5827.10	1	B	5894.73	1	B	5967.74	1	B
5827.62	2	B	5895.18	2 l	A	5968.82	3	A
5828.53	1	C	5896.31	2	B	5969.50	2	A
5830.50	3	A	5896.75	1	B	5970.81	2	B
5831.02	3	A	5897.39	3	A	5971.47	1	B
5831.74	3	A	5898.96	3	A	5972.10	1 Yt?	A
5832.42	2	B	5899.73	1	B	5972.55	1	B

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5973.03	1	B	6061.24	2 ES	A	6160.42	3	A
5975.54	1	E	6063.67	1 ES	B	6163.94	1 ES	B
5976.43	1 ES	B	6066.64	1	B	6164.51	2	A
5978.02	2	A	6067.38	2	A	6164.98	1	E
5979.38	2	A	6067.78	2	A	6165.85	2	A
5980.46	2 b	B	6068.27	1	A	6166.76	2 ES	B
5981.98	2	A	6070.06	3	A	6168.33	2	A
5983.13	1	C	6070.56	1	B	6169.85	1	E
5983.75	2 b	B	6074.96	2	B	6173.10	2	B
5985.48	1	B	6077.83	1	B	6173.94	2 ES	A
5989.69	2	A	6080.02	1 ES	B	6174.45	1	A
5991.69	2 b	A	6080.53	1	C	6174.96	1	A
5993.85	2 ES	A	6081.99	1 ES	B	6176.40	1 ES	B
5994.64	2	A	6082.66	2	A	6177.45	1	A
5995.14	2	A	6086.09	1	B	6178.65	1 Nd?	B
5996.06	2	A	6087.67	1	B	6179.40	2	A
5996.83	1 v	B	6088.09	1 ES	B	6179.82	2	B
5997.32	2	A	6088.63	2	A	6181.05	2	A
5998.08	1	B	6090.47	1	B	6181.88	2 ES	E
6001.09	1	B	6091.36	3	A	6182.89	2	A
6001.70	2	B	6091.94	1	B	6186.24	1	C
6002.84	2	B	6092.92	1	B	6186.85	1	C
6004.20	2	A	6093.69	1	B	6187.42	1	E
6005.14	1 I	B	6094.10	1	B	6188.00	2	A
6006.10	1	E	6095.25	2	B	6189.80	1 b, ES	A
6007.94	2 b, ES	B	6096.77	2 ES	A	6191.24	1 I, ES	A
6009.87	2	B	6099.06	2	A	6192.62	2	A
6010.26	1	B	6099.90	2	A	6193.07	1	E
6010.76	1	B	6101.40	1	B	6194.37	2	B
6011.27	2	A	6101.96	3	A	6195.14	1	E
6012.81	1	B	6103.32	3	A	6196.08	1	E
6013.40	2 Ce?	B	6104.82	2	A	6196.57	1	E
6013.83	1	B	6105.36	1	B	6197.37	1	B
6016.10	1	B	6107.13	1	B	6198.14	2 b, d?ES	A
6016.78	2	B	6109.23	1	A	6199.41	1	B
6017.39	3	A	6110.19	2	B	6200.07	1 ES	B
6019.17	1	E	6110.66	3	A	6201.11	1	B
6019.93	1 Yt?	C	6112.94	2	A	6202.44	1	E
6021.26	2	B	6114.58	3	A	6203.89	2	A
6021.75	2	B	6115.70	1	E	6205.78	1	B
6023.17	1	B	6117.78	2 v	B	6206.22	1	B
6023.65	2	B	6120.26	1	E	6206.83	2 b, d?	A
6024.44	1 b, d?	B	6121.81	2	B	6207.05	1	B
6027.14	2	A	6122.73	2	A	6208.98	1	B
6027.54	2	A	6123.60	2	A	6210.42	1	A
6028.67	2	B	6124.88	2	B	6212.64	1 I	E
6029.80	1	A	6125.83	1	B	6213.81	1	A
6032.45	1	A	6126.98	2	A	6216.44	1	E
6033.23	1	A	6128.76	2	A	6217.08	2 ES	A
6033.83	1 ES	A	6129.85	2	A	6218.22	1	A
6035.54	1 ES	A	6130.56	2	A	6219.17	1	A
6036.42	1 ES	B	6131.15	2	A	6220.83	1 h, I	B
6041.40	3	A	6133.16	2	A	6221.47	1	E
6042.76	2 b, v, ES	B	6138.01	2	A	6222.66	1	A
6043.33	1	B	6138.47	1	A	6223.62	2	B
6044.99	3	A	6139.31	2	A	6224.61	1	E
6045.42	3	A	6140.56	3	A	6225.19	1	B
6046.40	1	B	6143.13	2	A	6225.57	1	A
6047.42	2 v, ES	B	6143.61	1	A	6226.71	1	A
6049.20	1	B	6143.97	2	A	6228.26	1	B
6049.81	2 b, I	B	6144.76	1 h, I	E	6231.66	1	B
6050.28	2 b	E	6146.52	2	A	6232.74	1 b	E
6052.07	1	B	6147.37	1	E	6233.70	1	E
6053.10	3 ES	B	6148.23	1	A	6234.20	1	B
6056.50	3	A	6149.10	3	A	6235.09	1	B
6057.24	2	B	6149.90	1	B	6236.12	1	B
6057.67	2	B	6150.50	1 ES	B	6237.66	3	A
6058.40	1	B	6154.83	1 h	E	6238.30	2	A
6059.86	2 ES	A	6157.55	2 ES	A	6238.89	1	B
6060.73	2 ES	A	6159.48	4	A	6240.45	1	A

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I A.	Notes	Probable error	λ I. A.	Notes	Probable error
6241.54	1	A	6352.97	1	A	6474.25	3	E
6242.38	1	A	6353.47	3	A	6475.47	1	E
6244.21	2	A	6355.34	2	A	6476.43	1	B
6246.76	3	A	6357.27	3	A	6477.02	2	E
6248.09	2	A	6363.12	1	E	6478.22	1	E
6251.65	1	A	6366.17	1	E	6479.17	1	E
6256.02	1 b	A	6367.39	2	A	6483.35	1 1	E
6256.66	5	A	6368.28	3	A	6484.49	4	A
6257.91	1	A	6371.00	2	A	6487.62	4	A
6259.65	1	B	6371.89	2	A	6488.56	1	E
6260.09	1	B	6377.18	1 b	E	6490.82	4	A
6262.50	1 v	B	6378.01	1	E	6492.02	1	E
6264.15	1 b	B	6380.04	2	A	6493.14	1	E
6265.59	1	E	6380.67	2	A	6496.05	1	A
6267.28	4	A	6381.60	1	E	6497.83	2	B
6270.01	1	A	6384.24	1	E	6498.31	1	B
6271.43	1	A	6384.78	1	E	6498.67	3	B
6272.37	1	B	6386.82	3	A	6500.95	1	E
6273.32	1	A	6388.06	1	A	6502.00	2	A
6273.69	1	A	6389.85	3	A	6504.70	1	E
6275.03	1	A	6390.81	3	A	6505.51	1 b	E
6275.74	1	A	6392.37	1	E	6507.13	1	B
6276.73	1	B	6394.04	1 b	E	6507.70	2 1	A
6278.20	1	E	6395.34	1	E	6509.45	3 b, 1	C
6279.53	1	B	6398.29	1	A	6512.69	2	B
6281.85	1	E	6399.39	1	E	6516.14	1	B
6284.12	1	A	6399.86	1	E	6516.62	1	B
6285.13	1	A	6401.45	1	E	6525.51	1	E
6287.72	1	B	6402.10	1	E	6526.64	2	A
6290.71	1	E	6403.99	2 v	A	6528.00	2	A
6291.82	3	A	6404.52	1	E	6528.91	1	E
6292.92	2	A	6405.53	1	A	6529.64	2	A
6293.91	1	A	6406.24	2	A	6530.68	1	E
6294.80	2	A	6408.06	1	E	6532.21	1	B
6295.55	1	E	6410.26	1	E	6533.12	1	B
6295.99	1	A	6411.40	2	B	6533.90	2	E
6297.64	1	A	6417.50	3	A	6536.78	1	E
6300.12	2	A	6418.86	1	E	6537.52	1	E
6301.12	2	A	6419.32	1	E	6542.76	3	A
6301 83	1	A	6424.18	1	E	6543.29	1	B
6302.39	2	A	6425.90	2	A	6544.57	2	A
6303.15	2	A	6426.61	4	A	6544.91	1	E
6306.23	1	B	6428.32	2	A	6549.77	3	A
6309.87	1	A	6428.92	2	A	6550.92	1 Cu?	A
6310.24	1	E	6431.00	3	B	6551.78	2	A
6311.47	1	E	6431.96	2	B	6556.40	1	E
6313.16	1	E	6433.92	2	B	6557.00	1	B
6314.60	1	E	6435.29	2	B	6558.26	2	A
6315.78	2 ES	A	6437.58	2	B	6562.94	2	A
6319.00	1	E	6438.00	2	B	6563.48	1	C
6321.75	3	A	6439.72	2	B	6564.60	1	E
6322.48	1	A	6440.54	2	B	6566.41	2	B
6325.58	3	A	6442.03	1	E	6569.31	6	A
6326.23	1	E	6443.61	1	B	6570.67	4	A
6327.47	3	A	6447.49	2	B	6572.98	1	A
6328.00	1	A	6448.03	1	B	6574.38	3	A
6328.84	1 ES	A	6448.25	1	B	6575.95	2	A
6329.38	1 ES	A	6450.41	1	B	6577.36	1	B
6331.17	1	E	6452.06	2	B	6579.21	1	E
6331.75	1	C	6455.60	2 Ca?	B	6580.46	1	A
6335.37	1	B	6456.25	2	B	6581.15	1	B
6337.87	1	B	6457.53	1	B	6584.06	1	B
6338.90	1	A	6459.33	1	B	6585.21	4	A
6340.07	2	A	6468.28	1	E	6587.50	2	A
6341.41	1 Nd?	E	6468.91	1	E	6588.32	1	A
6342.14	1	A	6469.69	1 v	E	6588.91	3	A
6343.32	1 Dy?	E	6470.46	3	B	6589.72	5	A
6344.01	1	E	6471.57	3	B	6591.53	2	A
6348.92	1	A	6472.34	4	B	6592.96	1	E
6349.20	1	B	6473.24	1	E	6595.96	1	A

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
6596.96	2	A	6718.22	1	E	6848.87	1	B
6597.65	1	B	6719.59	1	B	6853.50	1	A
6598.88	1 v	E	6720.31	1	A	6853.88	1	A
6601.83	5	A	6721.56	1	A	6854.49	2	A
6603.50	1	B	6723.15	4	A	6856.03	5	A
6604.56	5	A	6724.73	3	A	6858.12	1	A
6607.08	1	E	6725.89	3	A	6861.12	6	A
6612.49	1	E	6726.81	1 b,l	B	6862.82	4	A
6614.82	2	A	6728.18	1	A	6867.08	1	B
6616.74	1	B	6731.84	6	A	6872.43	3	A
6617.61	2	A	6734.06	5	A	6873.60	1	E
6619.01	1	E	6734.81	4	A	6875.25	2	B
6625.28	2	B	6735.34	2	A	6877.10	2	A
6626.88	1	B	6746.41	1 b	B	6878.34	1	E
6627.45	1	E	6750.82	1 b	B	6879.51	2	A
6627.76	1	E	6754.80	2	A	6880.86	1	B
6628.88	2	A	6756.94	1	A	6883.39	1	E
6630.61	2	A	6759.24	2	A	6885.16	3	A
6632.28	4	A	6761.64	1	E	6887.42	1 b	B
6633.05	1	E	6762.06	1	B	6888.79	2	A
6635.18	2	B	6762.58	1	E	6891.46	2	A
6638.49	1	B	6764.23	1	B	6892.00	1	A
6639.32	1	B	6766.52	2 l	A	6900.28	2	B
6639.75	1	B	6769.40	1 v	B	6904.51	1	A
6640.60	1 b,d?	C	6770.37	1	B	6906.18	1	E
6641.49	1 v	E	6771.31	1	A	6909.81	2	A
6643.79	1	C	6771.98	1	A	6918.96	2	A
6645.08	1	E	6775.35	2 b	B	6925.19	1	B
6646.18	2	A	6778.19	3	A	6926.15	1	B
6648.23	2	B	6778.61	4	A	6927.02	2	A
6649.02	3	A	6779.15	1	A	6928.82	1 b	B
6651.61	3	A	6780.03	2	A	6929.59	1	B
6654.24	1	B	6781.17	2	A	6930.41	2	A
6656.19	3	A	6782.95	3	A	6934.28	1	B
6661.32	1	B	6784.35	1 v	C	6937.55	1	B
6661.58	1	B	6790.00	5	A	6938.74	1	B
6667.22	3	A	6790.83	1	A	6939.51	1	B
6669.31	1	E	6791.43	1	E	6941.56	2	A
6671.49	4	A	6792.55	2 b	A	6948.25	1	E
6672.13	1	E	6794.20	5	A	6949.22	2 b	B
6674.68	1	E	6796.13	1	A	6950.51	3	A
6675.55	1	B	6796.82	2	A	6952.42	1	E
6676.99	2	A	6799.59	1	E	6953.61	1	B
6677.46	1	E	6801.79	1	E	6954.32	1	B
6679.21	5	A	6804.86	1	E	6955.29	5	A
6681.53	3	A	6805.58	1	E	6958.98	1	B
6682.53	1	B	6807.50	1	B	6965.95	1	B
6684.42	1	B	6808.30	2	A	6966.49	1	B
6685.02	1	E	6813.42	1 b	B	6968.65	2 b, l	B
6686.30	1	B	6814.87	1	E	6969.69	1	B
6687.79	2	A	6815.50	1	B	6975.58	1	E
6688.78	1	B	6816.14	1	B	6975.99	1	B
6693.55	3	A	6820.91	2	A	6977.58	1	B
6694.69	2	A	6821.87	1 Cu?	A	6984.16	1	B
6696.77	1	A	6823.61	1	B	6985.67	1	B
6697.23	1	A	6826.68	1	E	6987.34	1	B
6698.05	1	E	6827.05	1	E	6988.34	2	A
6698.92	1	E	6827.74	1	A	6990.08	1	B
6702.19	1	A	6828.47	1	A	6993.41	1	B
6703.60	2	A	6829.17	1	B	7007.39	1	B
6704.26	1	A	6829.85	3	A	7008.45	1	B
6705.48	1	B	6830.52	2	A	7009.79	1	B
6706.78	1	E	6837.15	1 b	B	7015.37	1	E
6707.47	3	A	6838.28	2	A	7016.76	1	C
6710.70	1	B	6839.08	1	B	7020.44	5	A
6711.46	1	A	6839.65	1	B	7021.48	1	E
6712.13	1	A	6841.76	2	A	7022.66	1	B
6712.62	3	A	6844.70	4	A	7023.74	1 v	B
6713.79	1	B	6846.54	3	A	7026.62	2	B
6717.08	1	B	6848.15	3 b	A	7036.72	2 b	B

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
7039.22	6	B	7279.25	1	B	7863.64	1	A
7042.24	5	A	7281.50	1	B	7873.71	1	E
7049.15	1	B	7282.28	1	B	7875.11	1	E
7051.52	5	B	7283.38	1	B	7880.06	2	A
7054.97	1	B	7288.93	1	B	7895.96	1	C
7056.53	1	B	7290.23	1	B	7906.26	1	E
7064.97	1 b	B	7300.72	1 b	B	7914.96	2	B
7065.84	1 b	B	7316.34	1	E	7928.19	2	B
7067.36	1	B	7327.09	1	A	7937.04	1	E
7071.10	1	B	7332.65	1	A	7940.31	1	E
7074.67	1	B	7335.08	1 b	E	7948.12	1	E
7079.50	1	E	7338.04	1	A	7968.34	1	E
7082.37	5	B	7344.84	1	E	8001.59	2	A
7085.32	2 b, d?	B	7347.30	2	A	8004.97	1	B
7088.30	2	B	7362.99	1	E	8014.89	2	B
7091.16	2	B	7364.22	1	E	8017.18	1	E
7092.98	1 b	B	7371.50	1	A	8019.56	1	C
7096.93	2	B	7373.73	1	E	8021.61	1	B
7100.75	1	E	7375.22	1	E	8025.12	3	A
7102.02	1 b	B	7376.69	1	A	8029.56	1	C
7104.53	2	B	7383.54	1	A	8032.02	2	A
7106.21	2	B	7393.35	1	B	8033.70	1	C
7106.73	1	B	7394.05	1	B	8038.38	1	D
7110.57	1	E	7404.00	1	A	8040.27	1	C
7111.43	1	E	7412.15	1	E	8048.70	3	A
7112.72	1	E	7444.56	2	A	8065.16	1	B
7114.53	1	E	7445.41	2	A	8068.47	4	A
7115.28	1	E	7470.72	1	E	8070.37	1	B
7115.97	2	B	7481.99	1	B	8071.74	2	B
7117.52	1	B	7494.02	1	E	8076.29	1	B
7118.28	1	E	7502.36	1 b	B	8084.54	1	B
7119.81	1	B	7541.39	1	B	8087.09	1	E
7122.41	1	B	7543.62	1	E	8102.38	1	B
7123.29	1	E	7544.80	1	E	8104.58	1	C
7125.11	1	B	7546.64	1	E	8112.31	1	B
7131.80	1	B	7560.23	1	E	8116.20	1	C
7135.99	1	B	7562.90	1	B	8117.17	2	A
7136.43	1	E	7573.32	1	E	8121.22	1	B
7137.56	1	E	7576.09	1	A	8122.86	1	E
7138.01	1	E	7585.81	1	B	8125.12	2	C
7139.39	1	E	7588.40	1	E	8129.10	2	B
7141.15	1	E	7607.59	1	B	8132.00	1	B
7143.96	2 b	B	7638.09	1	E	8133.68	1	C
7149.60	3 b	B	7643.08	1	B	8135.37	1	E
7154.83	1	E	7645.82	1	B	8146.60	1	E
7156.19	1	E	7648.03	1	B	8148.16	1	E
7172.67	1	E	7667.19	1	E	8153.85	1	B
7186.31	1	E	7698.78	1	E	8158.89	1	E
7189.55	1	E	7728.56	1	E	8159.93	1	B
7204.09	1	E	7736.26	1	E	8161.88	3	A
7210.95	1	E	7749.25	1	E	8165.38	2	B
7213.82	1	B	7789.65	1	E	8167.25	1	B
7218.09	1 h	E	7801.54	1	B	8172.96	1	B
7220.10	1	E	7805.82	1	E	8180.34	1	E
7225.62	1	B	7808.90	1	E	8184.42	2	B
7228.91	1	E	7812.71	1	B	8186.31	2	B
7234.76	1	E	7813.60	1	E	8195.48	3	A
7235.64	1	C	7820.12	1	B	8203.98	2	B
7237.03	1	E	7831.39	1	C	8206.28	3	E
7240.90	2	B	7835.08	2	A	8208.33	2	C
7254.95	1	B	7837.27	2	A	8214.74	1	D
7257.11	1	B	7844.79	1	B	8218.76	3	B
7271.68	1	E	7846.10	1	E	8230.34	3	B
7273.88	1	B	7848.73	1	C	8240.98	3	A
7277.10	1	B	7859.53	1	C	8244.97	1	B

TABLE 2.—Arc Spectrum of Samarium—Continued

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
8246.52	1	B	8397.74	1	E	8677.93	2	A
8248.15	1	B	8409.84	1	E	8706.32	2	B
8249.38	1	B	8416.39	1	E	8708.43	3	A
8252.53	1 b	B	8421.39	1	E	8717.89	3	A
8258.06	1	B	8425.56	1	B	8724.55	1	C
8267.48	1	B	8427.40	1	B	8738.79	1	E
8269.06	1	D	8432.64	3	A	8741.73	1	B
8274.03	1	E	8437.67	2	B	8757.32	1	B
8277.81	1	E	8439.76	1	E	8758.28	2	A
8284.37	1	B	8454.77	1	A	8759.94	1	E
8286.15	1	C	8457.77	2	A	8768.61	1	E
8289.28	3	B	8465.08	1	B	8780.59	1	B
8292.32	1	E	8469.69	1	E	8785.78	1	E
8301.05	3	A	8473.55	3	A	8788.83	2	B
8305.79	4	A	8476.65	1	B	8808.40	1	B
8308.99	1	E	8478.24	1	C	8823.24	1	E
8312.76	2	B	8480.09	1	E	8837.37	1	E
8315.45	2	B	8486.00	4	A	8839.45	1	E
8318.90	1	B	8498.33	1	E	8846.46	1	A
8320.12	1	B	8506.78	2	A	8859.76	2	A
8325.33	1	C	8510.92	4	A	8867.42	1	E
8327.94	1	E	8521.21	1	E	8913.66	2	A
8330.55	1	E	8522.86	1	E	8916.73	1	E
8339.64	1	E	8528.87	1	E	8939.05	1	E
8341.64	1	E	8539.22	1 b, d?	C	8957.55	1	A
8344.61	1	B	8543.22	3	B	8976.65	1	C
8348.70	3	A	8557.12	1	C	8980.03	1	E
8355.25	2	A	8568.94	1	B	8989.07	1	C
8357.69	1	E	8575.80	1	B	9003.57	1	E
8367.00	1	E	8577.24	1	E	9012.19	1	B
8369.08	1	E	8586.05	1	B	9060.34	1	C
8370.38	1	E	8600.44	1	C	9062.98	1	C
8372.27	2	B	8609.29	1	C	9100.73	1	E
8376.99	1	E	8612.03	1	E	9119.12	1	E
8378.94	1	B	8617.05	3	A	9215.55	1	E
						9264.59	1	E
8383.71	3	A	8622.27	1	A			
8387.77	3	A	8632.83	3	A			
8390.29	1	B	8641.46	1	E			
8393.65	2	B	8645.02	1	E			
8394.92	1	B	8666.16	1	C			

3. LINES OF UNKNOWN ORIGIN

Table 3 contains the wave lengths of lines that have been observed in the spectra of both neodymium and samarium. Later research may reveal them either as lines properly belonging to each spectrum and approximately of the same wave length or as lines belonging to the spectra of other known elements. In the meantime it is thought best to segregate them into a separate table so that if they are characteristic of a new element they may be of service to chemists and others interested in the isolation of the members of the rare earth elements.

TABLE 3.—Lines of Unknown Origin Common to Nd and Sa

λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error	λ I. A.	Notes	Probable error
5483.10	3	A	5714.74	1	B	6111.76	1	B
5508.41	3	A	5716.06	1	B	6126.32	2	A
5510.08	1	B	5720.83	1	B	6135.82	2	A
5513.17	2	A	5739.97	3	A	6156.90	2	A
5523.88	2	A	5740.86	5	A	6169.15	2 ES	B
5539.19	2 ES	A	5758.88	1	A	6172.53	2	A
5542.32	1	A	5765.46	2	A	6210.70	1	A
5551.38	3	A	5775.49	1	B	6289.90	2	A
5554.24	1	B	5789.88	2	B	6305.19	1 Gd?	A
5557.41	2	A	5792.40	2	B	6307.06	2	A
5558.10	1 ES	A	5796.43	1	B	6308.28	2	A
5562.78	2	A	5803.10	1	B	6317.72	1	B
5563.77	1	B	5807.81	1	B	6330.14	1	B
5566.62	1	B	5818.30	2	A	6346.53	1	A
5576.42	1	A	5822.63	1	B	6394.91	1	A
5583.25	2	A	5829.70	3	A	6454.83	2	B
5585.09	1	A	5845.90	2	A	6461.20	1	B
5585.61	2	A	5863.47	2	A	6506.32	1	B
5596.96	1	B	5894.04	1	B	6520.33	1	B
5597.57	2	B	5906.65	2	A	6637.17	2	A
5599.48	1	A	5913.86	1	B	6743.57	1	B
5603.15	2	A	5927.26	1	B	6748.35	1	B
5603.63	3	A	5932.48	1	B	6803.06	3	A
5604.84	2	A	5935.54	1	A	6873.06	2	A
5608.10	1	B	5949.11	1	B	6985.22	1	B
5608.42	1 ES	B	5959.45	1	B	7018.87	1	B
5615.68	1	B	5961.50	2	A	7095.51	2	A
5616.88	1	A	5963.22	2	A	7101.44	1	B
5617.67	3	A	5970.16	1	B	7227.19	1	B
5623.59	2	A	5974.22	2	A	7254.95	1 n?	B
5630.10	2	A	5982.35	2	A	7794.53	1	A
5635.03	1	B	5984.32	3	A	7798.37	2	A
5641.60	1	B	5989.33	3	A	7823.31	1	A
5650.80	1	A	6001.95	1	B	7868.14	1	B
5651.95	2	A	6014.59	2	A	8026.32	3	A
5657.87	1	B	6030.33	1	A	8055.56	1	B
5681.92	2	A	6053.83	3	A	8322.04	1	B
5685.97	1	B	6061.85	2	A	8504.71	2	B
5692.60	2	A	6074.43	1	A	8526.43	1	B
5694.54	2 Cu g?	A	6075.70	2	A	8544.72	1	B
5698.91	3	A	6084.11	3	A			
5702.72	2	A	6089.65	1	A			
5703.46	2 ES	B	6095.68	1	B			
5706.20	5	A	6098.20	1	B			
5713.03	1	A	6104.35	2	B			

WASHINGTON, January 6, 1922.